CHARACTERISTICS OF BLACK TERN (*CHLIDONIAS NIGER*) NESTING HABITAT AT LAKEVIEW WILDLIFE MANAGEMENT AREA, NEW YORK

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The Black Tern (*Chlidonias niger*) has been declining over most of its range in North America and is on the U.S. Fish and Wildlife Service (USFWS) list of Migratory Non-game Birds of Management Concern. Black Tern is considered endangered in Pennsylvania, Ohio, Indiana and Illinois and is of special concern in Ohio, Iowa and Wisconsin (Carroll 1988, Hands *et al.* 1989). Rates of decline on USFWS Breeding Bird Surveys were 4% per year between 1966 and 1987 in Iowa, Minnesota and Wisconsin (Hands *et al.* 1989). In Canada, the rate of decline over the period 1966-1985 was 7.9% (Carroll 1988). The Black Tern currently is listed as a bird species of special concern in New York State (New York State Department of Environmental Conservation 1987) and has been recommended for re-listing as endangered (Carroll 1988) due to population declines during the last 25 years. For example, the population at Montezuma National Wildlife Refuge has declined from 2000 birds in 1958 to no breeding birds in 1990 (Carroll 1988, Novak 1990). The number of Black Tern observed along the upper Niagara River during fall migration declined from 5500 in 1965 to 60 in 1987. The causes for Black Tern population decline are not well understood. However, lack of proper breeding habitat, organochlorine contamination of food sources, predation, competition, disease or parasites, adverse weather conditions and human disturbance all have been proposed as contributing factors (Hands *et al.* 1989).

I examined the possibility that breeding habitat conditions are limiting Black Tern populations in New York. The objective of this study was to identify microsite characteristics near nest sites which may be different from characteristics of the interior open water/marsh edge in general. Previous studies have described habitat conditions within Black Tern nesting areas in qualitative ways; few have tried to quantify these variables. Cuthbert (1954) stated that nests were located where the vegetation was low and thin, in bulrushes (*Scirpus* spp.), mixtures of cattails (*Typha* spp.), bulrush and Yellow Pond Lily (*Nuphar luteum*), or Bur-reeds (*Sparganium eurycarpum*). Dunn (1979) reported that preferred nest sites were in dispersed cattail growth and were rare in dense old stands of cattail. Bailey (1977) found

most nests in and around large beds of Great Bulrush (*Scirpus acutus*). Others have found Black Tern nest sites mainly associated with Broad- and Narrow-leafed Cattail (*Typha latifolia* and *Typha angustifolia*) (Bergman *et al.* 1970, Bailey 1977, Hands *et al.* 1989, Novak 1990). Wetland size and configuration also may be important. For example, Black Tern appeared to prefer a 50:50 ratio of vegetation to open water (Weller and Spatcher 1965), and Brown and Dinsmore (1986) reported that Black Tern in Iowa was not found in wetlands < 5 ha in extent and was found in wetlands 5-10 ha only when they were within a larger wetland complex.

STUDY SITE

Lakeview Wildlife Management Area (WMA), located in the Town of Ellisburg, Jefferson County, New York (43° 51'N, 76°11'W), is a 1376 ha marsh separated from eastern Lake Ontario by a 7.24 km long barrier beach (Figure 1). Lakeview WMA contains both deep emergent and shallow emergent marsh, and sedge meadow. Approximately 90% of the marsh vegetative cover consists of deep emergent marsh (cattails) with some floating-leaved aquatics (*Nuphar luteum* and *Nymphaea odorata*) and bulrushes. Shallow emergent marsh occurs on the edges of the closed cattail stands and contains grasses (*Calamagrostis canadensis* and *Phalaris arundinacea*), bulrushes and sedges (*Carex* spp.). The sedge meadow is dominated by tussock sedge (*Carex stricta*). Approximately 20-25% of the marsh is open water.

METHODS

A thorough search for Black Tern nest sites was conducted at Lakeview WMA on 22 June 1990 as part of the New York State Department of Environmental Conservation 1990 Black Tern nesting survey. To quantify differences in habitat variables between the nest sites and the interior open water/marsh edge, 25 random 1 m^2 plots of interior marsh vegetation found along the open water/closed marsh edge were compared to plots $\leq$10 m from Black Tern nest sites identified during the above survey. Data were collected on 8 and 13 July. Interior marsh sites surrounded by vegetation were not sampled because they were inaccessible.

Depth of the water at the center of the plot and maximum height of the vegetation above water were measured to the nearest 0.1 m. The percent cover of vegetation and percent exposed water and mud were estimated and

the dominant plant species within each plot recorded. Unpaired t-tests were used to compare differences between habitat variables near the nest sites and the marsh in general.

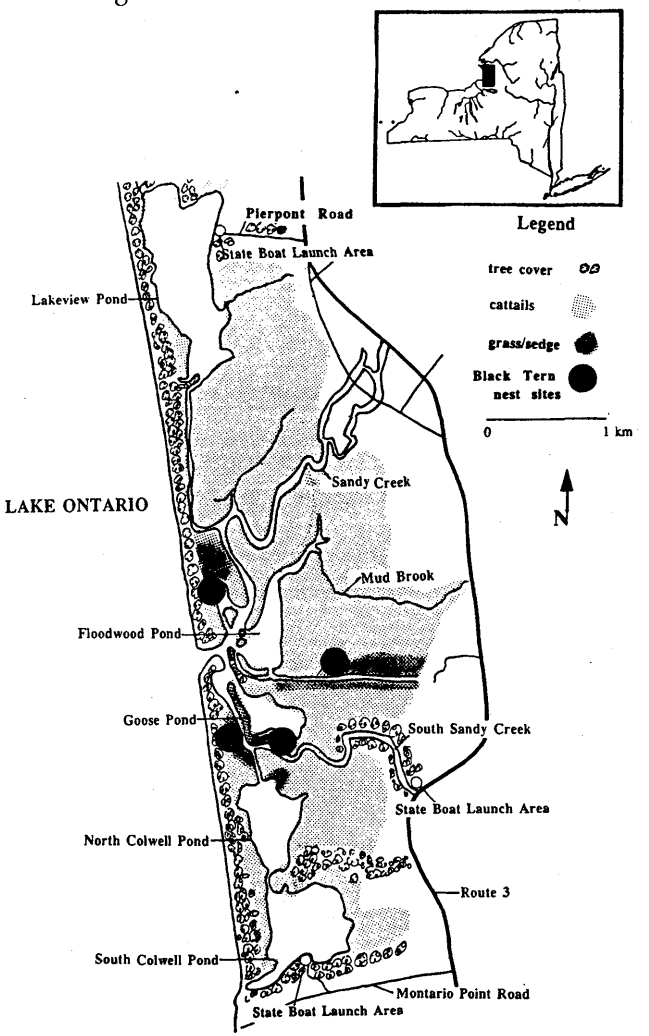

Figure 1. Black Tern nest sites at Lakeview WMA during 1990 and location of the study site within New York State.

RESULTS

Black Tern nested at four sites at Lakeview WMA in 1990 (Figure 1), with an estimated total of 19 nests there. Sixteen nests at four locations were marked by flagging. Nests conformed to previous descriptions of size, composition and substrate (Goodwin 1960, Bailey 1977, Hands *et al.* 1989). The nests were built upon stable, floating mats of vegetation, predominantly Wapato (*Sagittaria latifolia*), sedges, bulrush and smartweed (*Polygonum* spp.), grasses and some cattails. The nesting materials included cattail, sedges and grasses.

Water depth of the marsh edge was deeper (mean=0.6 m; $p<0.01$) than at Black Tern nest sites (mean=0.4 m) (Table 1). The vegetation was also taller (mean=1.6 m; $p<0.01$) in the marsh than in the nesting areas (mean=1.0 m). Black Tern nest sites had more mud exposed (mean=6%; $p=0.01$) than the marsh edge in general (mean=1%). The marsh edge had more water exposed between the vegetation (mean=22%) than the nest sites (mean=16%), although the difference was not statistically significant ($p=0.14$). There were no significant differences in percent vegetative cover between the marsh edge (mean=77%; $p=.75$) and the nest sites (mean=78%). Dominant plant species near nest sites included Wapato and sedges. The sampled interior open water/marsh edge was dominated almost exclusively by narrow-leaved cattail. A list of aquatic and emergent plant species found at Lakeview WMA is found in the Appendix.

Table 1. Comparison of habitat variables between Black Tern nest sites and the interior water/marsh edge in general.

habitat variables	mean values				t	p -value
	marsh		nest site			
	(n=25)	S.E.	(n=25)	S.E.		
water depth (m)	0.6	0.03	0.4	0.03	6.01	0.0001
max. height of veg. (m)	1.6	0.08	1.0	0.06	6.25	0.0001
% exposed water	22	3.9	16	2.2	1.52	0.14
% exposed mud	1	0.6	6	1.9	-2.66	0.01
% vegetative cover	77	3.8	78	2.1	-0.32	0.75

DISCUSSION

The results of this study indicate that Black Tern at Lakeview WMA prefer shallow emergent marsh/sedge meadow rather than deep emergent cattail marsh for nesting. Comparison sampling of the water/closed marsh edge rather than of interior sites surrounded by vegetation was done because of accessibility. It was beyond the limits of this study to access marsh sites surrounded by vegetation, due to the inability to walk or canoe to such sites. However, at Lakeview WMA Black Tern appears to prefer nesting sites near open water (Figure 1), so this study helps define characteristics of the interior open water/marsh edge which may be important.

Although the measurements were taken mid-season rather than at the beginning of the season when terns were selecting nesting sites, the location of the cattail and grass/sedge plant communities did not change during this short interval. Water depth, height of vegetation, and percent exposed water and mud likely change during the season. Water levels would be expected to be lower over the whole marsh as the season progresses. Percent exposed water and mud would also be expected to be lower. Whether there is a differential effect between the two plant communities is not known. Plant height in the grass/sedge community never reaches the height of the cattail community. Therefore, these results should be interpreted as showing a general preference of Black Tern for shallow emergent marsh/sedge meadow, with the measurements representing mid-season average values for these plant communities. Repetition of this study early in the nesting season and at other locations is recommended to define a range of values for the measured variables early in the nesting season.

It appears that Black Tern is already using most areas of shallow emergent/sedge meadow vegetation within Lakeview WMA (Figure 1). Constriction of these habitats may lead to continued declines in the number of nesting Black Tern at Lakeview WMA or its possible extirpation at this site. Could loss of shallow emergent marsh habitats be partly responsible for the decline of the Black Tern in New York and elsewhere? What processes maintain these habitats within a cattail-dominated marsh complex?

The composition of wetland vegetation is directly influenced by water level changes (Gilman 1976) as well as other environmental influences such as ice and snow cover in winter (Geis 1985). Perhaps natural water level fluctuations in Lake Ontario prior to 1960 and the beginning of water level control at the Moses-Saunders Power Dam near Massena provided enough

disturbance to set back succession and maintain a larger area of shallow emergent vegetation than is present now. Inland freshwater wetlands are often associated with rivers and streams and subject to disturbance from flooding and seasonal water level changes. The hydrologic regime of many of these wetlands has been changed due to agricultural and urban drainage and filling, channeling of streams, and construction of ponds and reservoirs which decrease or eliminate flooding. While wetland vegetation may continue to be present in these areas, the type and configuration of vegetation could be different than in the past.

Muskrat (*Ondatra zibethica*) has been suggested as a key species in maintaining the habitat necessary for Black Tern nesting (Carroll 1990). It maintains open water pools within the marsh by eating marsh vegetation. Their mounds and feeding areas provide platforms for nesting Black Tern. No Muskrat were seen during this study; one mound was present but did not appear to be occupied. Absence of these mammals may also contribute to deterioration of appropriate Black Tern nesting habitat.

Habitat requirements for Black Tern may be defined at four levels: the immediate nest site, the colony, the marsh, and the regional landscape. The immediate nest site requires the right combination of vegetative cover (for chicks to hide in) interspersed with open water, vegetation height, and suitable nest sites (tussocks, floating materials). There must be enough of this habitat to support a colony, although it can be somewhat scattered as Black Tern is a "loose" colonial nester (Cuthbert 1954). The marsh must support not only the physical nest, but the nutritional needs of the adults and developing chicks, and provide energy stores for the fall migration. Adequate insects, crustaceans, and fish must be available at the critical times in chick development which requires adequate open water area. Lakeview has approximately 20-25% open water, probably less at the height of seasonal vegetative growth. Other studies have shown that 50% open water is required (Weller and Spatcher 1965). Also, the marsh must be a relatively clean environment, free of toxic chemicals. In New York, most of the large Black Tern colonies are located adjacent to Lake Ontario. Lakeview WMA is part of a complex of marshes and bays extending along the entire eastern shore of Lake Ontario. This complex represents a distinctive landscape pattern.

Any one of the above habitat requirements may be limiting the Black Tern population in New York and elsewhere. This paper attempts to define habitat qualities of the immediate nesting site selected by Black Tern. Characteristics

of interior open water/marsh edge habitats may be important factors in nest site selection and maintenance of the population.

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Appendix. Aquatic and emergent plants found at Lakeview WMA 1990.

Scientific name	English name
Asclepias incarnata L.	Swamp Milkweed
Brasenia schreberi Gmel.	Water-shield
Calamagrostis canadensis (Michx.) Beauv.	bluejoint grass
Carex crinita Lam.	sedge
Carex stricta Lam.	tussock sedge
Ceratophyllum demersum L.	Coontail
Decodon verticillatus (L.) Ell.	Water-willow
Eleocharis rostellata (Torr.) Torr.	spikerush
**Hydrocharis morsus-ranae* L.	Frog's-bit
**Iris pseudacorus* L.	Yellow Iris
**Lythrum salicaria* L.	Purple Loosestrife
Lysimachia thyrsiflora L.	Tufted Loosestrife
Myriophyllum exalbescens Fern.	water milfoil
Nuphar luteum (L.) Sibth. & Sm.	Yellow Pond-lily
Nymphaea odorata Dryand. ex Ait.	water-lily
Panicum rigidulum Bosc ex Nees	panic grass
Pontederia cordata L.	pickerel-weed
Potamogeton crispus L.	pondweed
Potamogeton natans L.	pondweed
Potamogeton pectinatus L.	Sago Pondweed
Potamogeton richardsonii (Benn.) Rydb.	Red-head Pondweed
Ranunculus longirostris Godr.	White Water-crowfoot
Sagittaria latifolia Willd.	Wapato
Scirpus fluviatilus (Torr.) Gray	River Bulrush
Scirpus tabernaemontanii Gmel.	Soft-stem Bulrush
Sparganium eurycarpum Engelm. ex Gray	bur-reed
Typha angustifolia L.	Narrow-leaf Cattail
Utricularia vulgaris L.	Common Bladderwort

Names follow Mitchell (1986).
*naturalized, non-native species